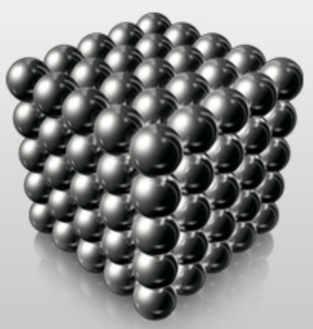
Advanced Backup Architectures for Mac OS X

Session 640

These are confidential sessions—please refrain from filming or taking pictures.



Enterprise IT

Advanced Backup Architectures for Mac OS X

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Enterprise Professional Services Manager

http://developer.apple.com/wwdc2005/

Introduction

- Backup terminology
- Basic backup building blocks
- Advanced backup architectures
- Backup solutions vendors for Mac OS X
- Customer success stories
  - Dark Horse Comics—BakBone, NetVault
  - Kansas City Life Insurance—Dantz/EMC, Restrospect
  - The Cimarron Group—Atempo, Time Navigator

Backup Concepts

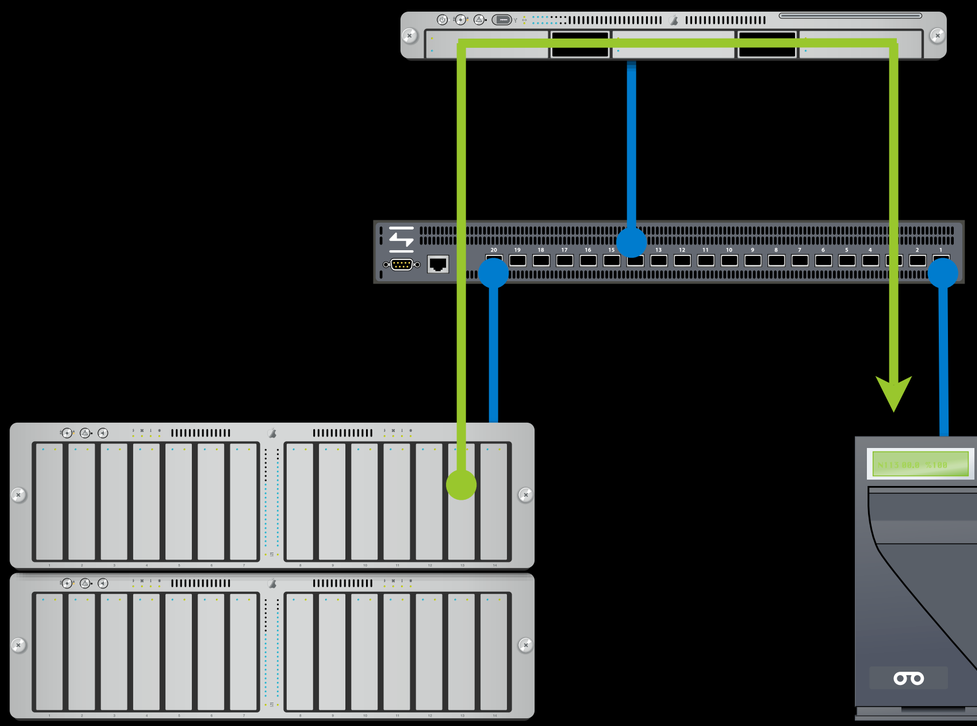
- FC—Fibre Channel
- SAN—Storage Area Network
- NAS—Network Attached Storage
- D2D2T—Disk to Disk to Tape
- Disaster recovery
- Replication/mirroring
- Snap shots

Basic Backup Architectures

- Backup Server
- Backup Client Agents
- Staging (D2D2T)
- LAN Free
- SAN Backup

Backup Server

Server-based backup



Xserve Backup Server

Fibre Channel switch

Xserve RAID

Fibre Channel based Tape Library

Server-Based Backup Products

PROS

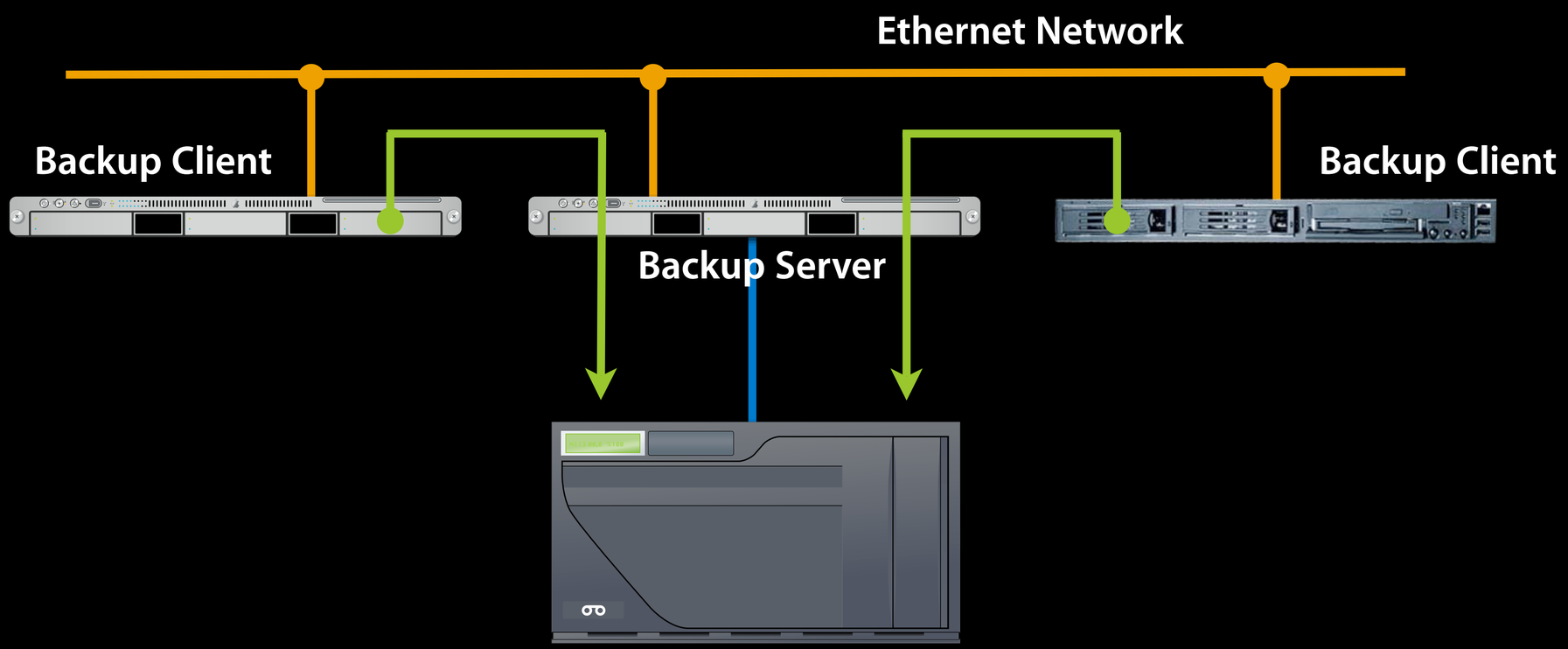
- 1-to-1 backup relationship
- Fast backup directly from source disk to target device (tapes or disks) using SCSI or Fibre Channel path
- Supports Automated Tape Library
- Fast Recovery due to high SCSI/Fibre Channel bandwidth

CONS

- Poor allocation of backup resources
- Does not scale
- Administrators have to backup their own servers
- Recovery speed dependent on tape library throughput

Backup Client Agents

Network-based backup



Backup Client Agents

PROS

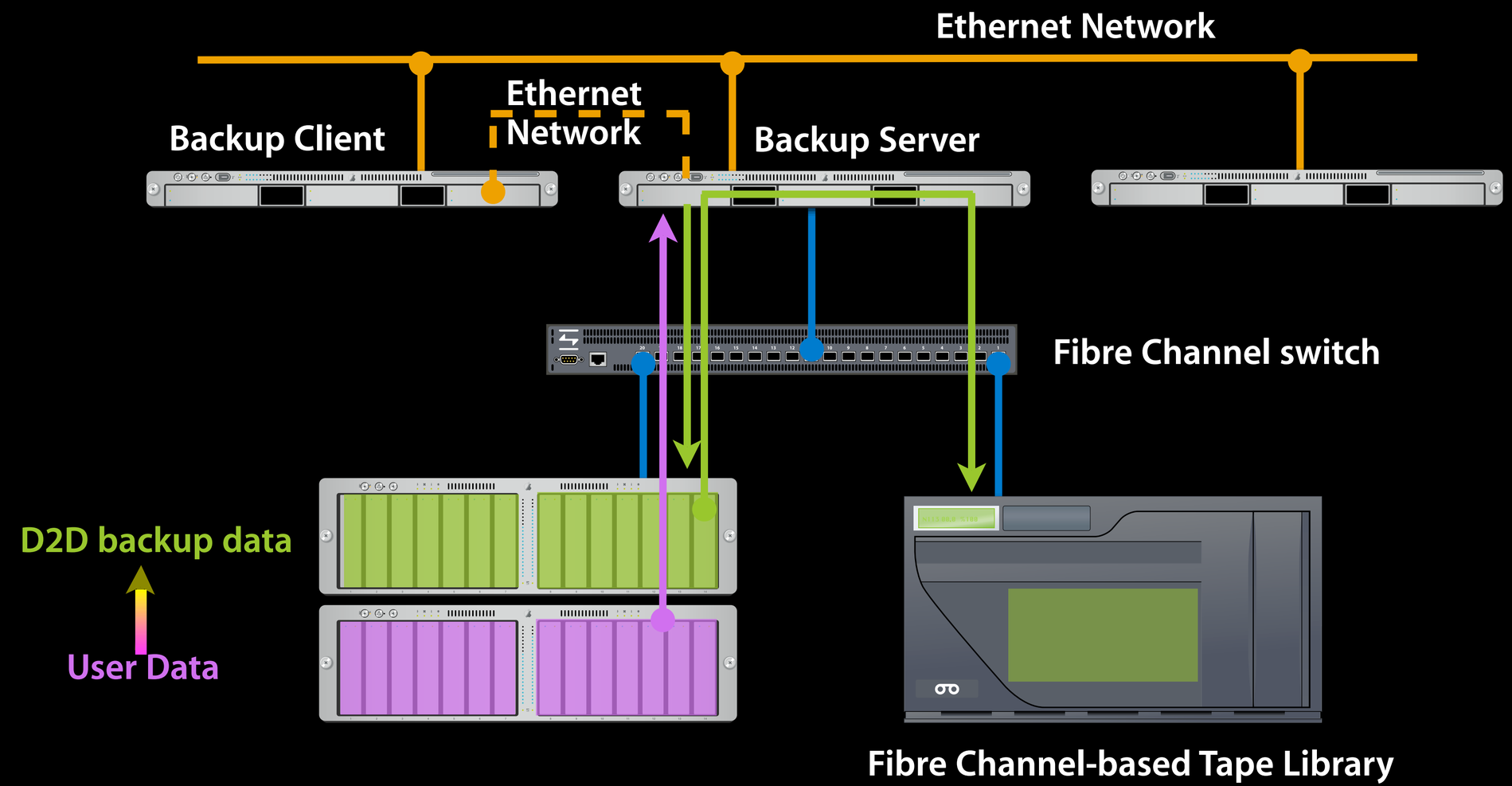
- Fits into existing heterogeneous Backup Infrastructure
- Good performance when used with High Speed (GigE) Networks
- Easy to add New Platform Support

CONS

- Slow backup and restore performance for large data set
- Need multiplexing to handle multiple clients
- Doesn’t solve problem of large backup windows
- Uses LAN resources and more CPU intensive

Staging Architecture

Disk to disk to tape



Staging (Disk to Disk to Tape)

PROS

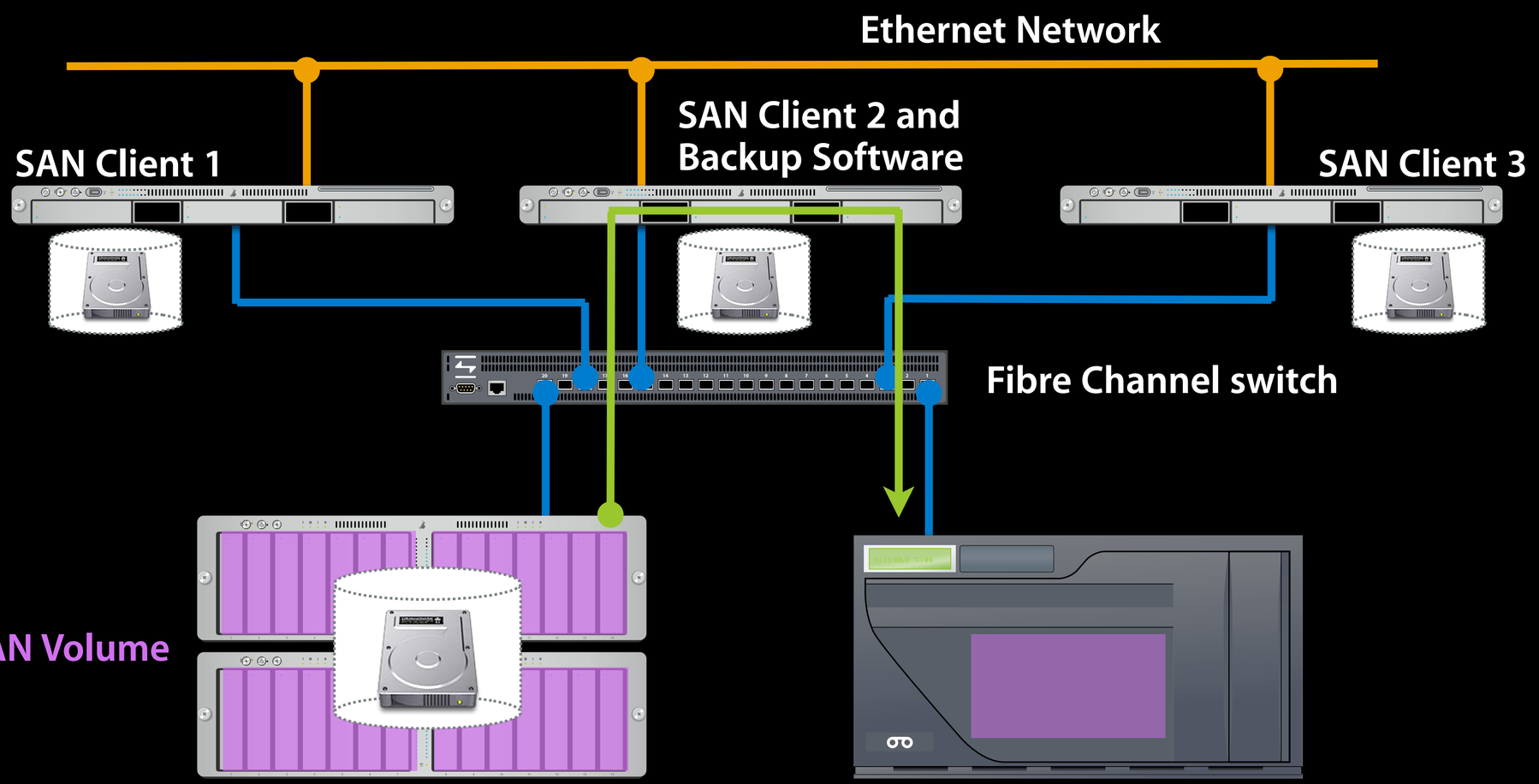
- Centralized Administration
- Easy access to most time critical data
- Takes advantage of high throughput using disk to disk
- Migrates older data to less expensive archive media (tape)
- Better reliability and fast restore

CONS

- More complex
- More expensive solution

LAN Free—SAN Backup

Fibre Channel SAN backup



Simple SAN backup (SAN to Tape)

PROS

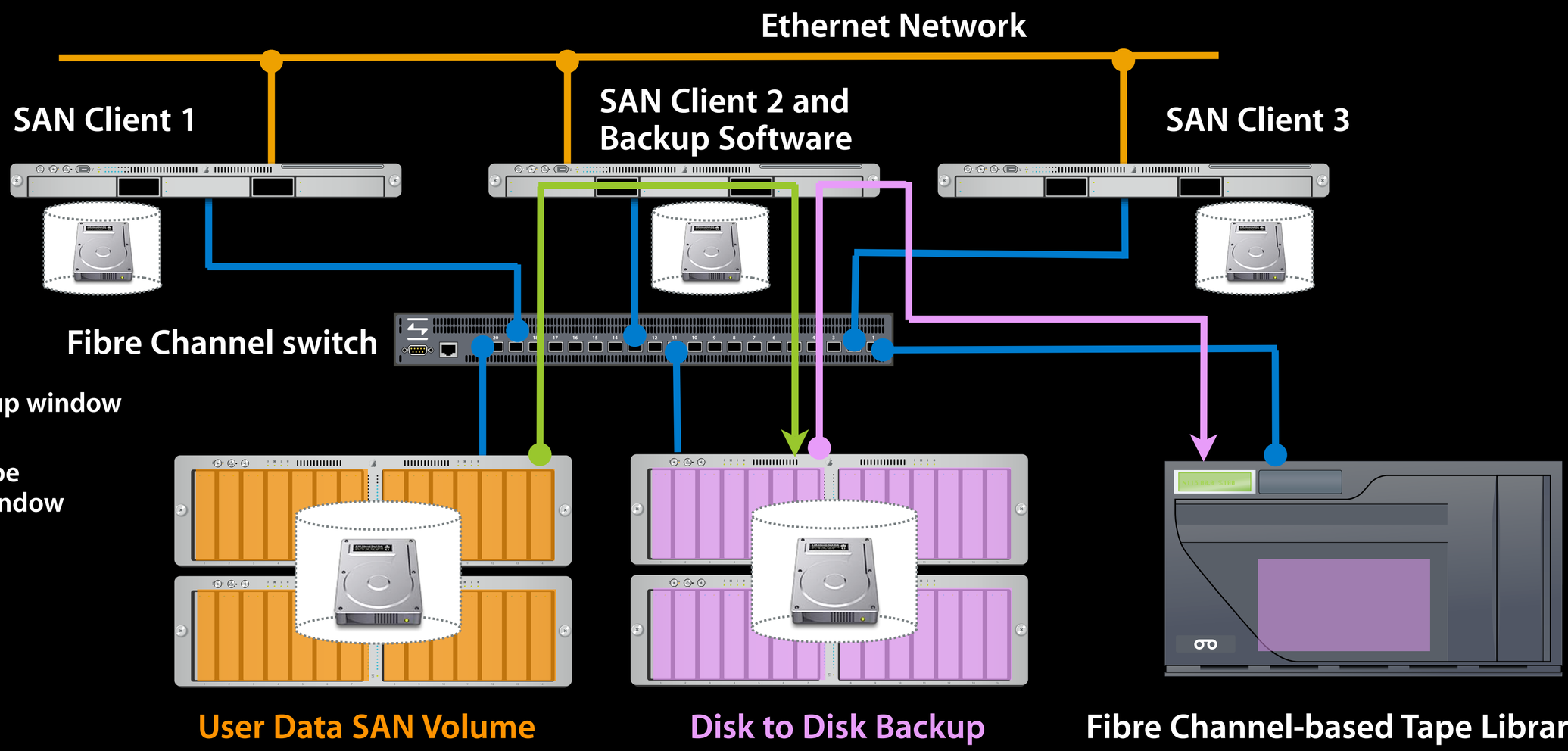
- Centralized Administration
- Easy access to most time critical data
- Migrates older data to less expensive archive media (tape)
- Servers dedicated to backup entire data set

CONS

- Speed of Backup and Restore dependent on tape mechanism
- More complex
- More expensive solution

SAN Disk to Disk to Tape

Fibre Channel backup



Staging (Disk to Disk to Tape)

PROS

- Centralized Administration
- Easy access to most time critical data
- Takes advantage of high throughput using disk to disk
- Migrates to media for off-site long term compliance (tape)
- Better reliability and fast restore

CONS

- More complex
- More expensive solution

Advanced Backup Architectures

- Disaster recovery plan
- Bare Metal Restore
- Replication
- Mirroring
- Snap-shots

Disaster Recovery Plan

- A disaster recovery plan in not a product !
- What is your BCP or BPCP
  - Business continuity plan
  - Business process contingency plan
- New regulatory pressure
  - Sarbanes-Oxley, HIPAA, European Data Protection Act, FISMA, GLBA, NERC, e-commerce laws
  - Policies, process management, audit, compliance…
  - Storage management software $5.6B in 2004, $6.3B in 2006

Bare Metal Restore

- “A Bare Metal Restore is the process of reformatting a computer from scratch after a catastrophic failure. Typically the process involves reinstalling the operating system and software applications and then, if possible, restoring data and settings.”
- Process of recovering from scratch (Pre-OS recovery)

Replication/Mirroring

- "Replication is the process of automatically duplicating and updating data on multiple computers across a network"
- Questions that you should ask yourself
- Synchronous or Asynchronous transfer
  - Distance replication latency issues
  - File-based replication vs. volume based
  - How often do you replicate the data
  - Do you replicate over the LAN (IP) or over SAN

Examples of Deployments

http://developer.apple.com/wwdc2005/

DNS/DHCP/OD Master

DNS/DHCP/OD Replica

MDC Xserve

MDC Xserve

Web Server

QTSS Server

AFP/SMB Server

Metadata/Journaling

Extra LUN

Hot Spare Drive

Exabyte Magnum

Private Metadata switch

APC UPS

Tape Backup

Ingest

Playout

On-Air Graphics

Shared Storage

Near-Line Storage

Craft Edit Bays

SanBox2-64 48-port configuration

Metadata servers

Customer Success Stories

Dark Horse Comics
Kansas City Life Insurance
The Cimarron Group

http://developer.apple.com/wwdc2005/

Dark Horse Comics

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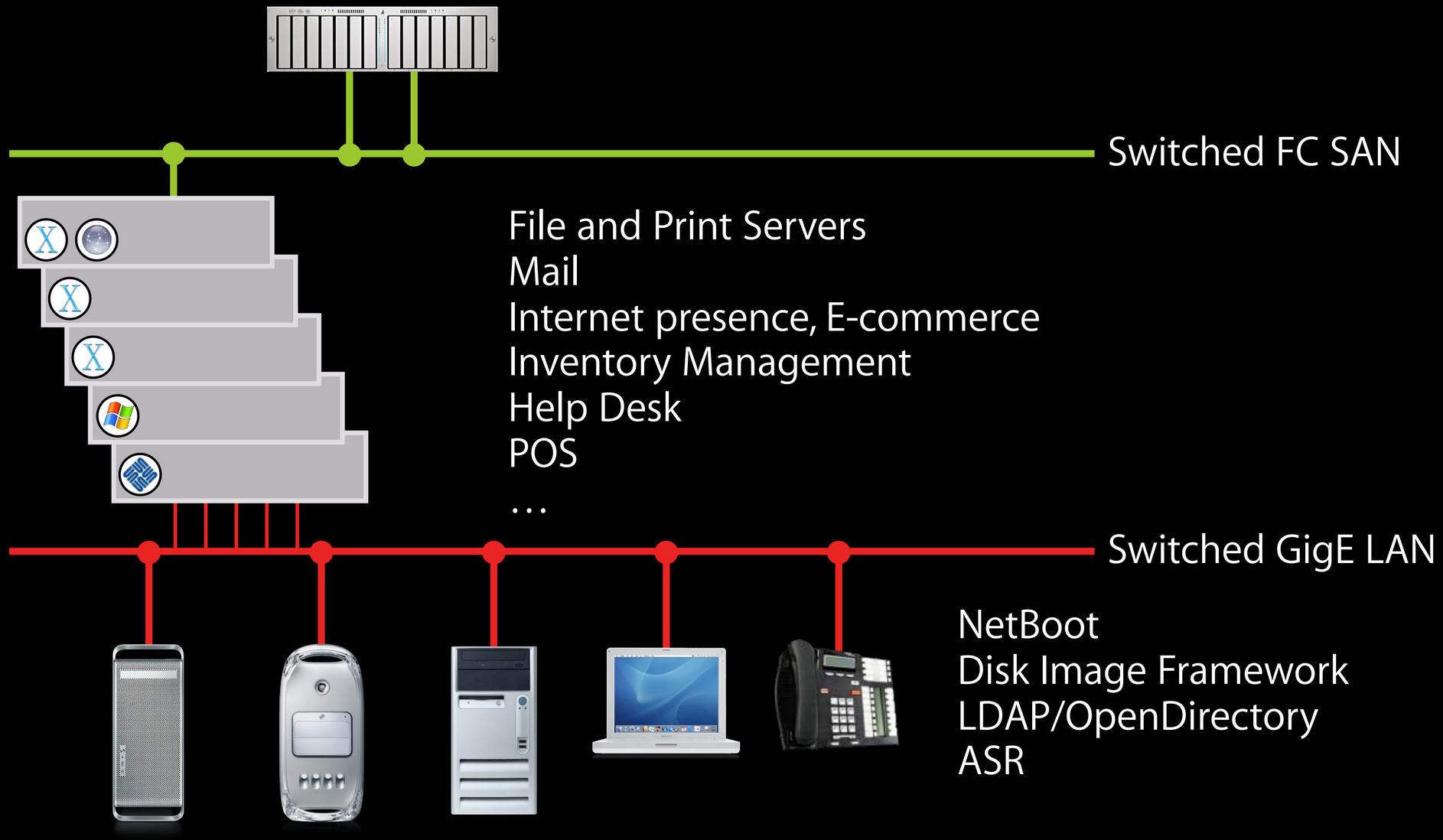
About Dark Horse Comics

DARK HORSE COMICS®

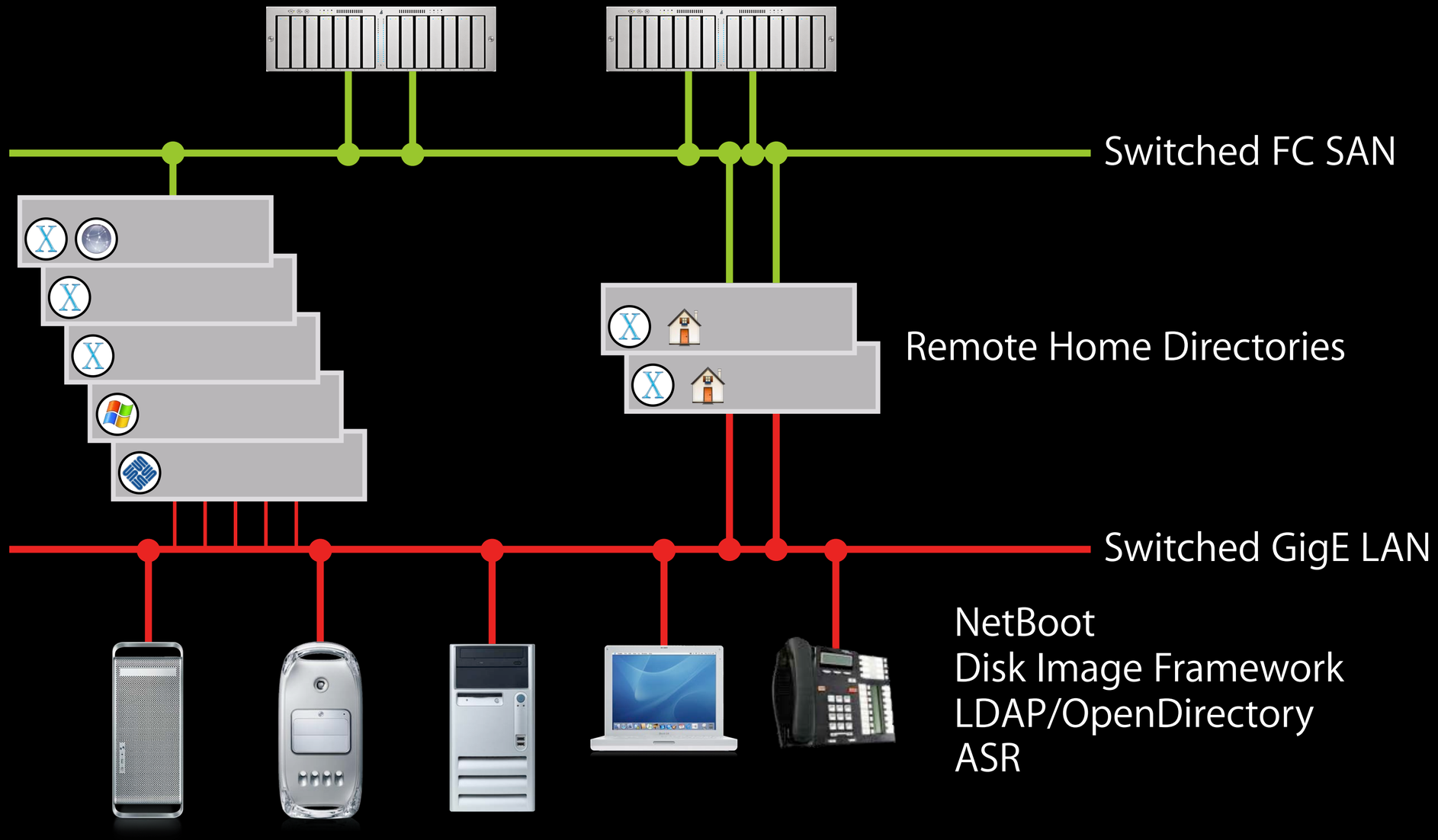
DARK HORSE ENTERTAINMENT

tfaw.com
THINGS FROM ANOTHER WORLD

DH Corporate Architecture—Current



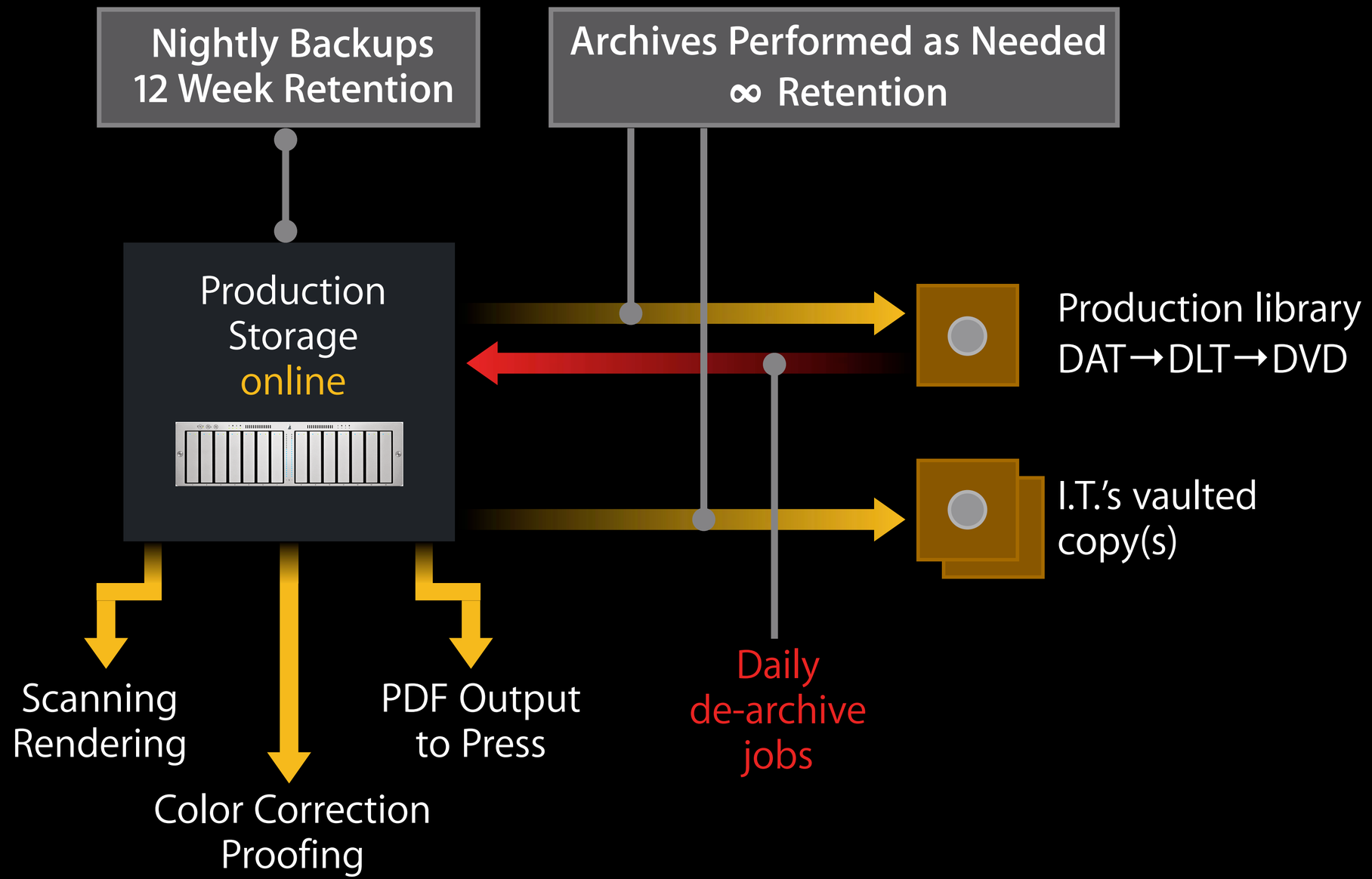
DH Corporate Architecture—Current



Backup Numbers

- 1 TB highly active production files
- 4 TB archives across mixed platforms
- 1 TB other department files, homes, etc.
- No user data on typical desktops
- Some user data on laptops

Existing Publication Data Flow



Backup Problems Recognized in 2004 Q4

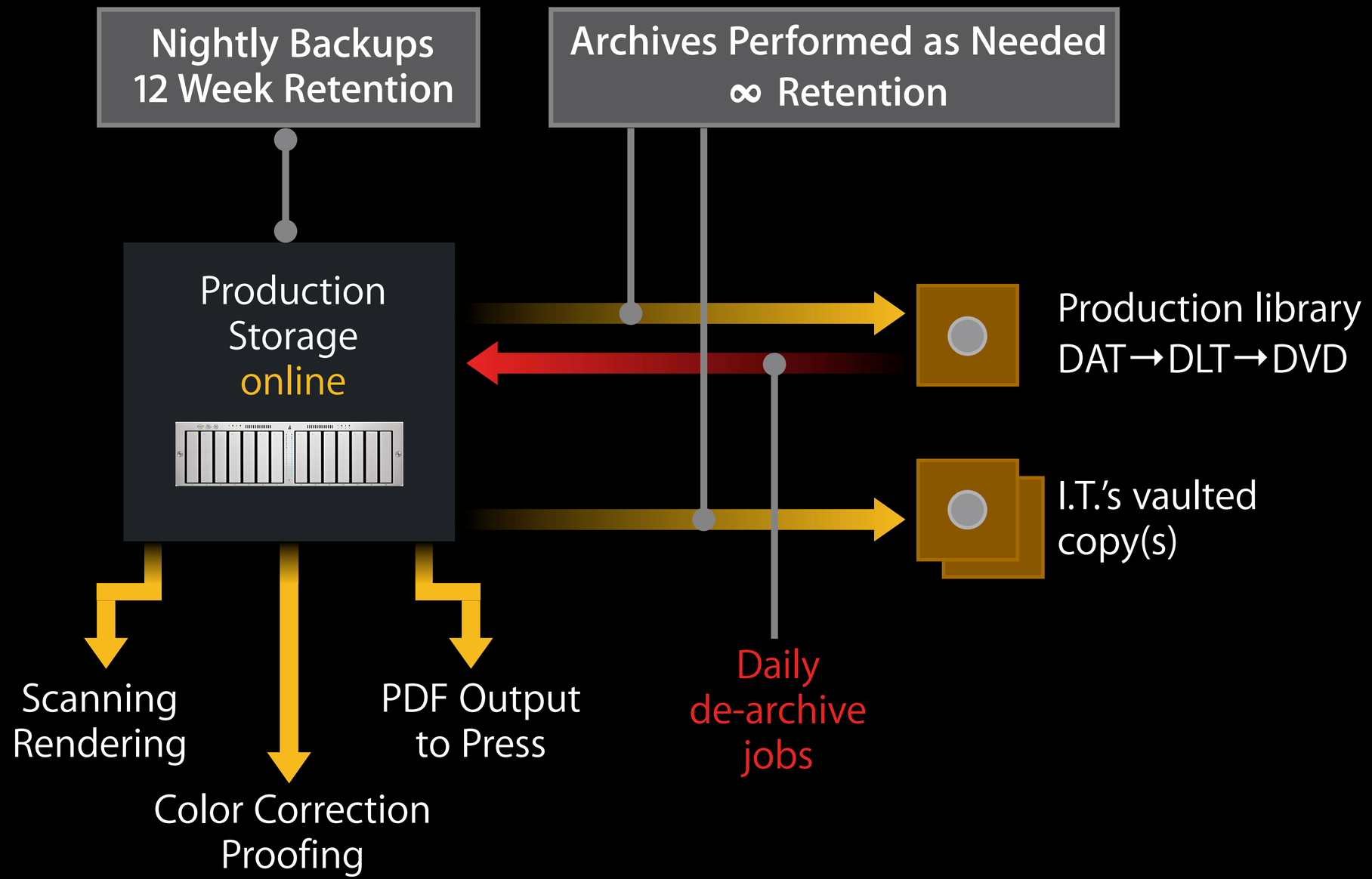
- Unacceptable downtime risk—restore time
- Expensive—End of Line—Media: M2
- Backups take too long to run
- Excessive admin overhead managing tapes
- Nonuniform production library for end users

Selecting a Media Platform

Raw media costs compared—late 2004

Exabyte Mammoth 2	$1.51/GB	12 MB/s	Our current platform
Quantum SDLT 320	$.30/GB	16 MB/s	Selected Drive Equipment: PowerLoader 1 LTO 2 drive expands to 2
LTO Ultrium 2	$.27/GB	30 MB/s	
Sony AIT-4	$.34/GB	24 MB/s	
Apple Xserve RAID	$2.89/GB	63+ MB/s	Almost no seek time formatted usable RAID5

Existing Publication Data Flow



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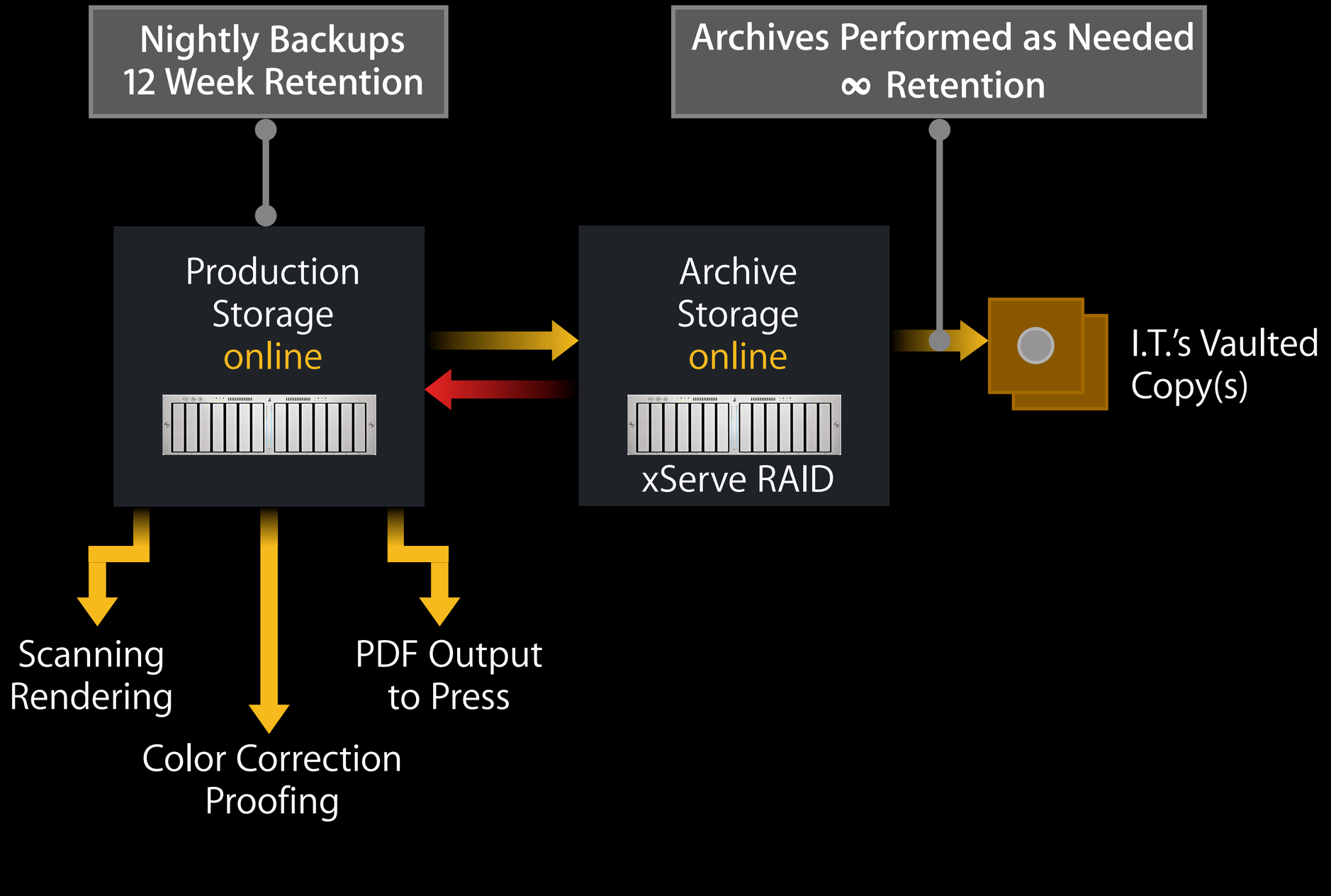
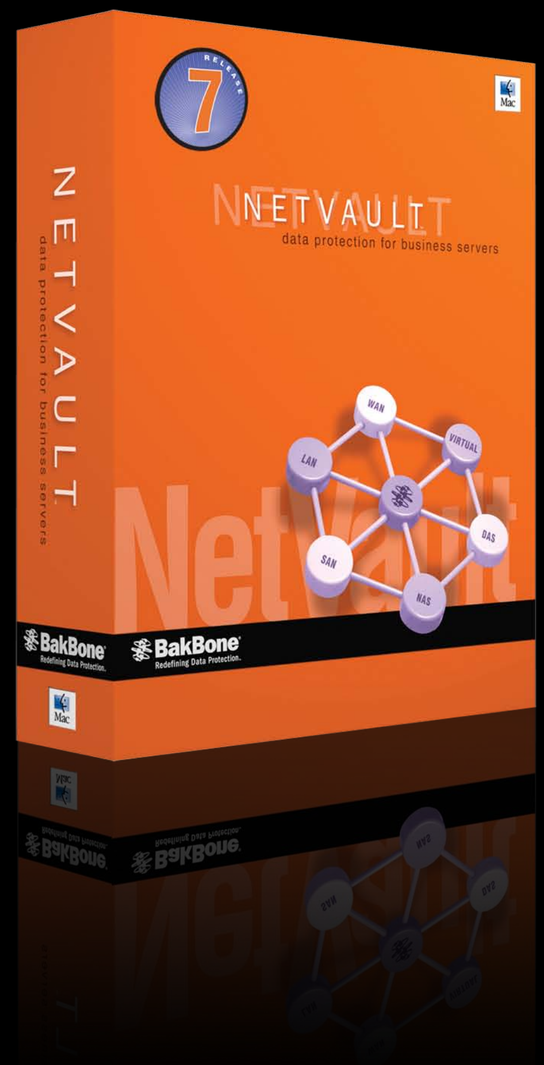


Software Platform Priorities

- Scalability
- Cost
- Mac Enterprise Support
- Performance

Our selection:
BakBone NetVault for OS X



Our NetVault Configuration

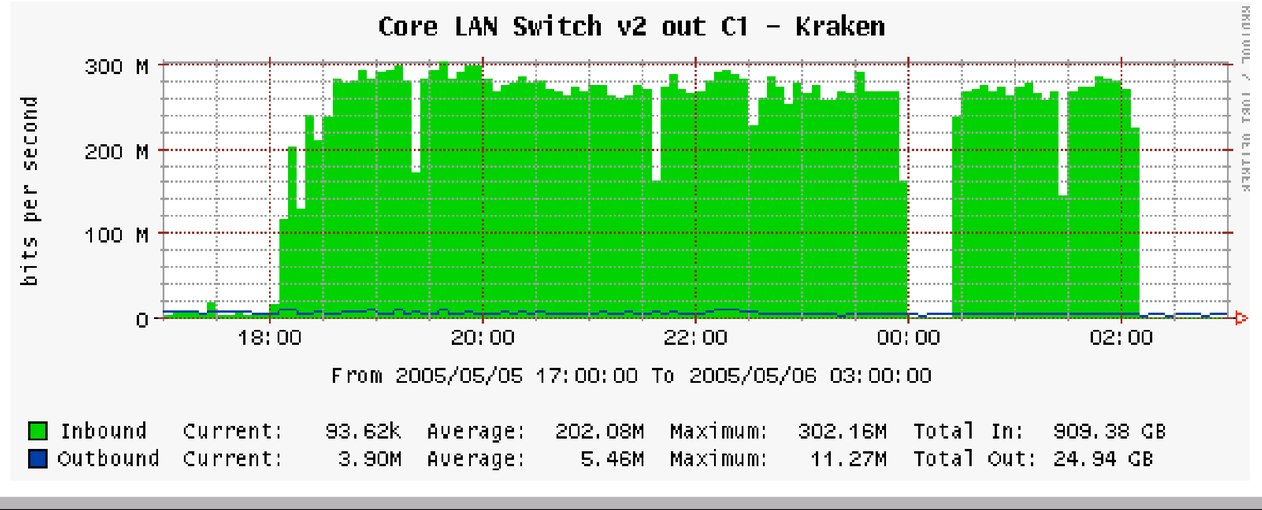
- Backup server attaches between LAN and Ultrium 2 Drive (SCSI)
- G4 DP800 running 10.3—fast enough for single drive

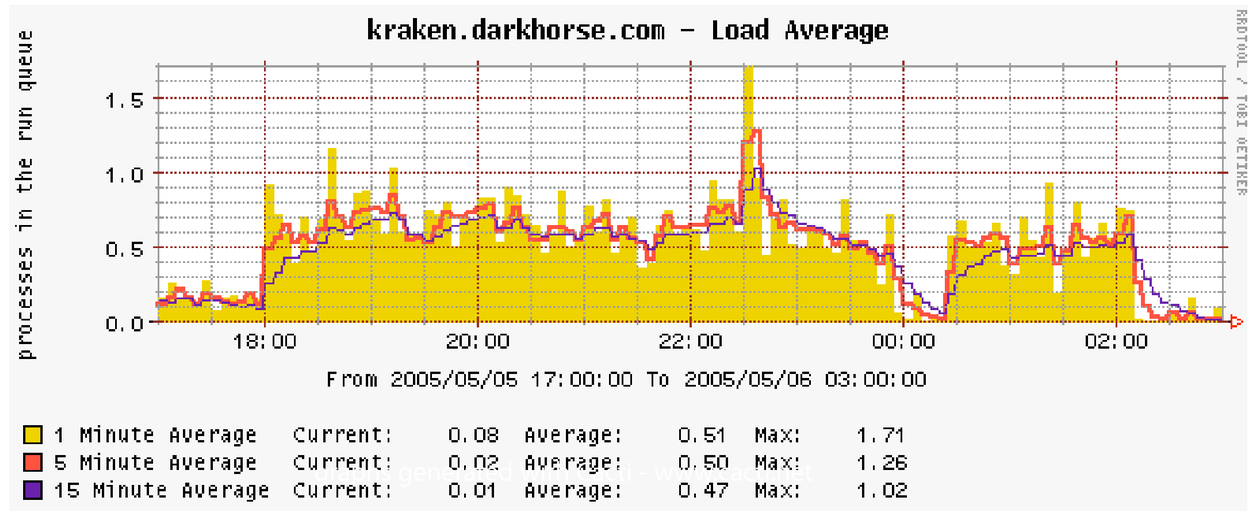
Pool Name	Type and Frequency	Size of pool	Recycle after
Super Full	Full every 6 months	2 full cycles ≈20 tapes	11 months
Full	Full every 2 weeks (except when running a super full)	7 full cycles ≈70 tapes	12 weeks
Incremental	Incremental every night	12 weeks ≈18 tapes	12 weeks
Archive	Full/Incremental as needed	Grow as needed will add ≈4 in `05	Never recycle
ReArchive	Full, converting/cloning legacy media	Grow as needed ≈16	Never recycle

Our NetVault Configuration

Performance

NetVault OS X Client
G4 DP1.42
best 5 minutes 36.6MB/s
load average hovers around 0.8

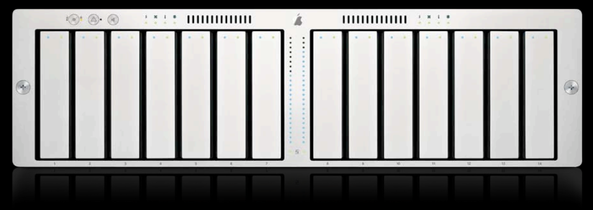




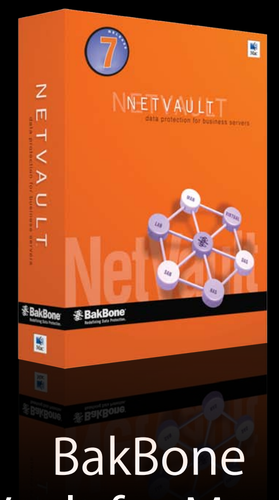
Backup Problems… Solved

- Downtime risk reduced—restore time ≈1/3
- Inexpensive media: Ultrium 2
- Shorter manageable backup windows
- Simplified tape management
- Easy to use, uniform, online archives

Overland
Storage Ultrium 2



Apple
xServe RAID



BakBone
NetVault for Mac OS X

Kansas City Life Insurance

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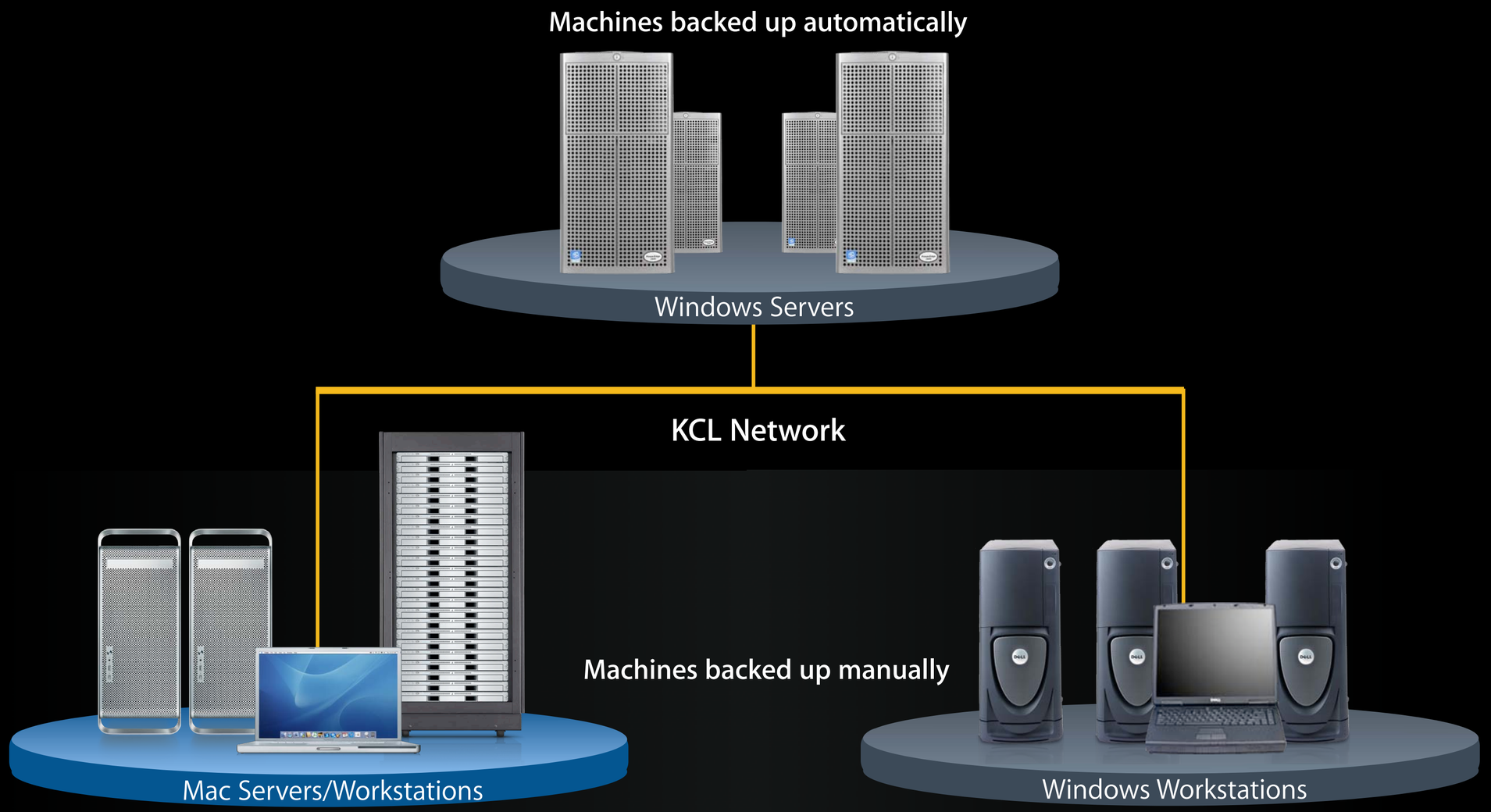
http://developer.apple.com/wwdc2005/

Kansas City Life Insurance

- Publicly traded insurance and financial services company, (ticker symbol: KCLI), based in Kansas City, MO
- Insurance/financial services business for 110 years
- $4.6B in assets
- $502M Revenue
- KCL Home Office
  - 600 employees
  - 800 computers (20 Macs, rest Windows)
- Data preservation is not only critical for our business, but is mandated by law

The Problem With Only Backing up Servers



Backup Isn't Just for Servers Anymore

- "Clients" == computers not in a server room
- We use a Windows-based product to back up our Windows servers to AIT-2 jukeboxes
- Clients backed up manually to the network
- Fairly common arrangement in the enterprise

Backup Isn't Just for Servers Anymore

There are problems with manual client backup

- You want to say, post-crash, "Well, that'll learn you", political realities dictate this won't happen
- High-profile crashes showed the manual user backup policy had… weaknesses

Although our backup system is excellent

- It's excellent for Windows. The Mac client has issues…
  - Security: Client access password is insecure
  - Procedural: Client polls server to request backups
  - Speed: Couldn't saturate an 802.11b connection

Backup Isn't Just for Servers Anymore

Like many other enterprises, the 'backup window' is an issue

- Even just backing up Windows servers, we don't have a lot of time to spare
- Adding in very slow clients with large data sizes would exacerbate this
- Adding all the PC laptops to the mix, it would get worse

So, we had to go with a separate system, with its own server and tape drives

Requirements

The new toy in town

Major requirements

- Solid Mac and Windows support
- Good support for laptop/mobile backups
- Reasonably secure
- Able to run well on an Xserve without needing a SCSI card that we didn't have an extra slot for
- "Fire and Forget"
- Zero effort for the user for backup and very little effort for restore

The Solution

Retrospect 6.0 from (EMC) Dantz

We have modest needs

- We may have, someday, 100 clients with just their home directories backed up to a small tape library
- We chose the Exabyte VXA-2 1U FW 800 library
- Provided suitable speed and capacities for our needs
  - Easily racked, needs less room than the Xserve
  - Fastest client connection is 100 Mbps Ethernet, so drive and FW 800 speed not an issue
  - Ten—tape library, we do a 5-day incremental backup, so unit capacity is perfect for our needs

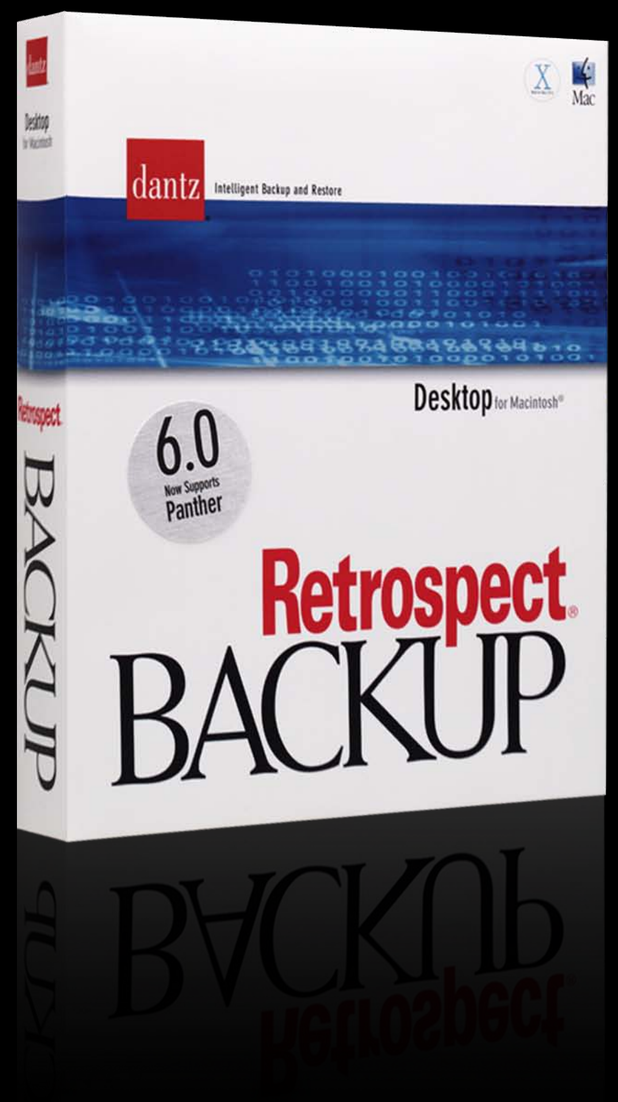
Current Backup Setup

Exabyte VXA-2 1x10 1U Tape Library

- 10—tape, single—drive library for under $3K
- Small 1U unit that's dead simple to set up
- Includes command line utilities for management
- Intuitive front console
- Barcode reader
- It's been just a fantastic bit of hardware for us

Retrospect 6.0 from (EMC) Dantz

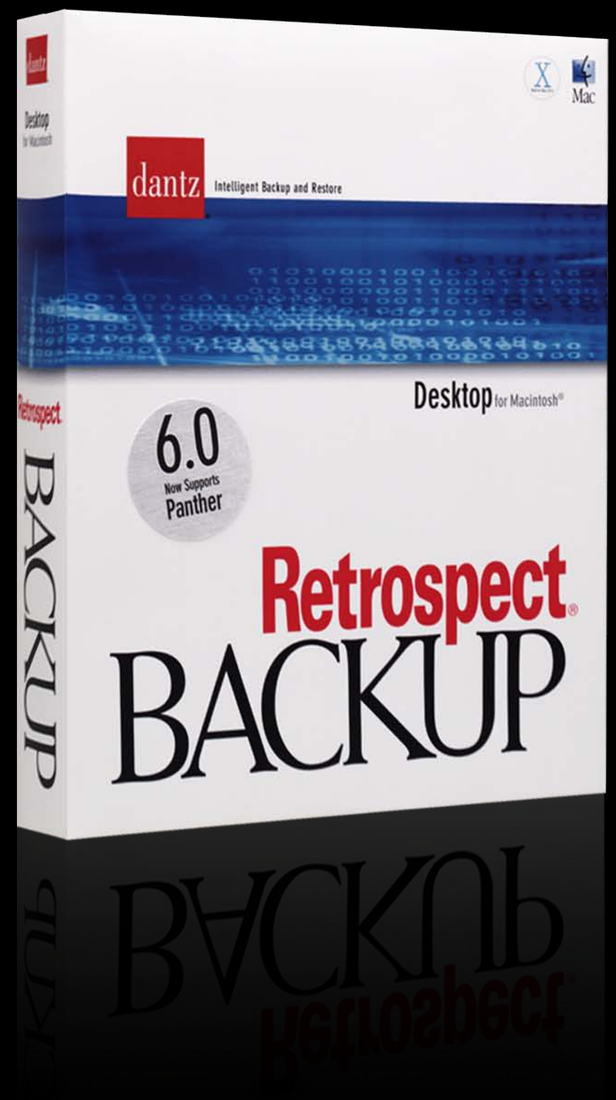
- Tests showed Retrospect was much faster than the other system: ~280MB/min vs. 20MB/min
- Retrospect's selectors allow for fine-grained selection
- Dantz's mailing list has been all the support I've needed for almost ten years
- Only issues were firmware on the tape unit and Windows client version issues, both solved in about a day



Retrospect 6.0 from (EMC) Dantz

Excellent laptop support

- Since the server, if the laptops are away, they don’t get backed up
- Backups are transparent and restores nearly so
- The Mac server’s client support fits our needs perfectly
- We don’t need the ultimate backup tool



End Results

Retrospect Does the Job

- It’s been running for over six months without complaint or the need for excessive care and feeding
- We’re up to about 25 clients, increasing at about 4 a month
- It’s been a PR bonanza for CIS at KCL
- Retrospect is one of the most boring server applications I manage

The Cimarron Group

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http://developer.apple.com/wwdc2005/

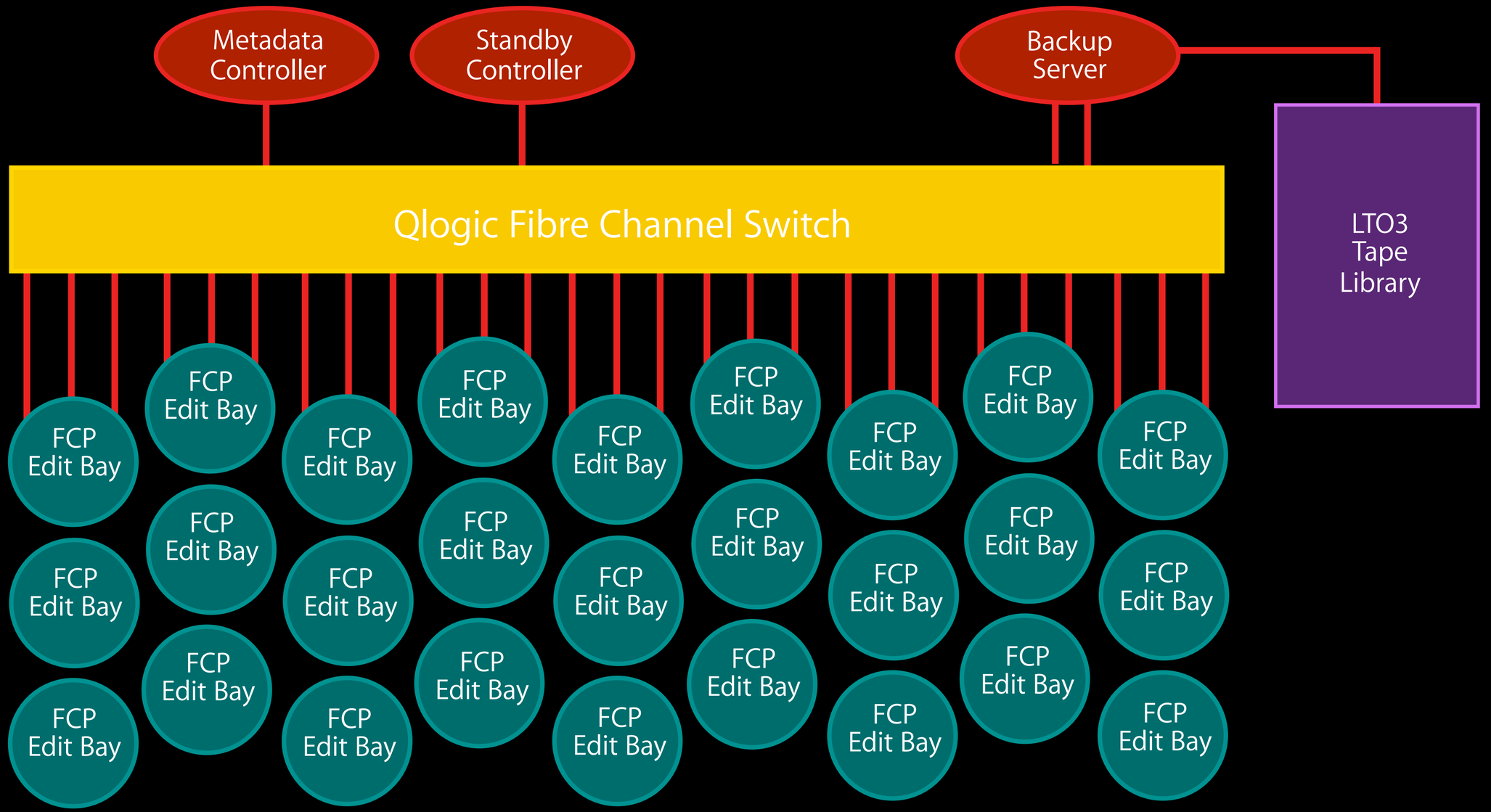
Company Overview

- Established in 1979
- Largest advertising agency for the Motion Picture industry
  - Movie trailers/TV spots
  - One-sheets (posters)
  - DVD box design
  - DVD menu animations
  - Websites

Overall Architecture

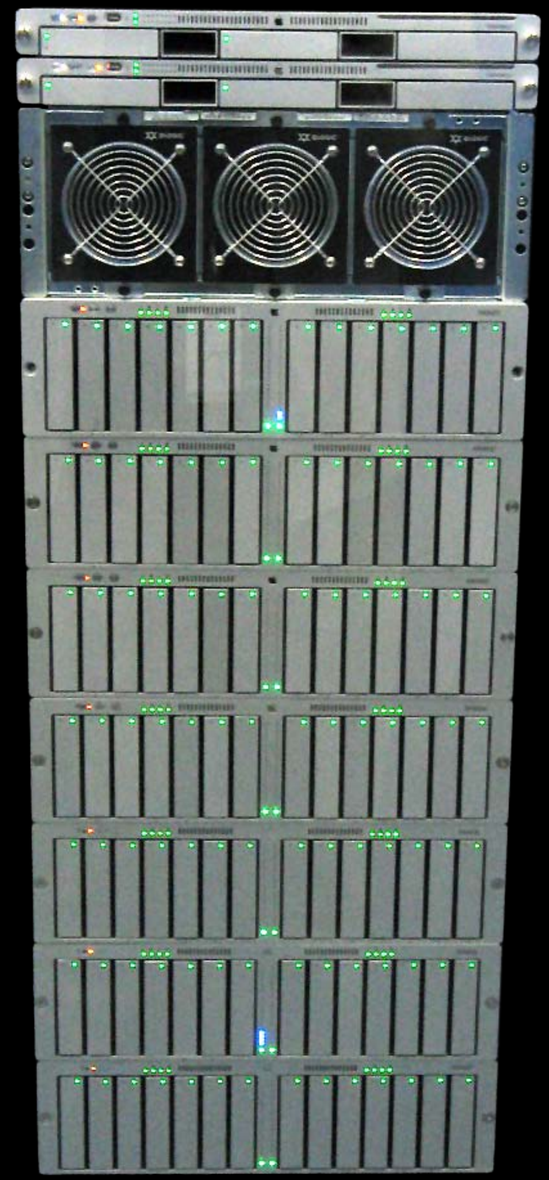
- 24x7 Facility
- Apple Final Cut Pro
  - 25 Compressed DV Edit Bays for offline editing
  - 2 Uncompressed Edit Bays for finishing
  - All stations share media
  - Uncompressed Edit Bays access offline rough cuts
  - ALL 27 stations access centralized music and sound effects Libraries

System Architecture



Storage Architecture

- Implemented with Xsan
- 7 Xserve RAIDs
  - 3 Volumes
    - Offline video (16 Terabytes)
    - Online video (4 Terabytes)
    - Music/sound effects (4 Terabytes)
- Qlogic SANbox 2-64
  - 64-port 2Gbit/s Fibre Channel Switch
- Dedicated Xserve G5 for backup
  - Multipathed FC for maximum performance



The Challenge

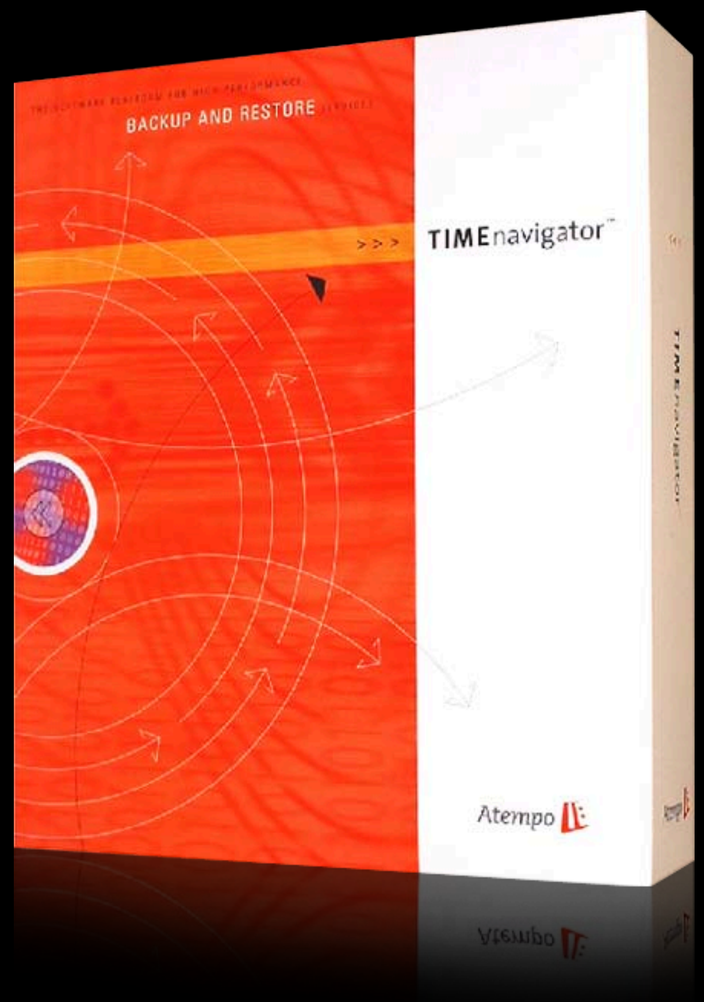
- Need regular backup of 24 Terabytes of data
  - RAID 5 protection must be supplemented by tape
    - Full backups on weekends (48 hour window)
    - Incrementals every weeknight (6 hour window)
    - Must have minimal impact on production workflow
- Need to archive data
  - Duplicate on-site and off-site tapes needed for archives
    - On-site for immediate retrieval
    - Off-site for disaster recovery

The Pains of Evaluation

- Compared several different backup vendors over several months and ran into the following problems
  - Maximum File/Volume size limitations
  - No Apple Xsan support
  - No LTO3 tape library support
  - No simultaneous stream support
  - No parallel streaming
  - Poor support
  - Poor backup/restore performance

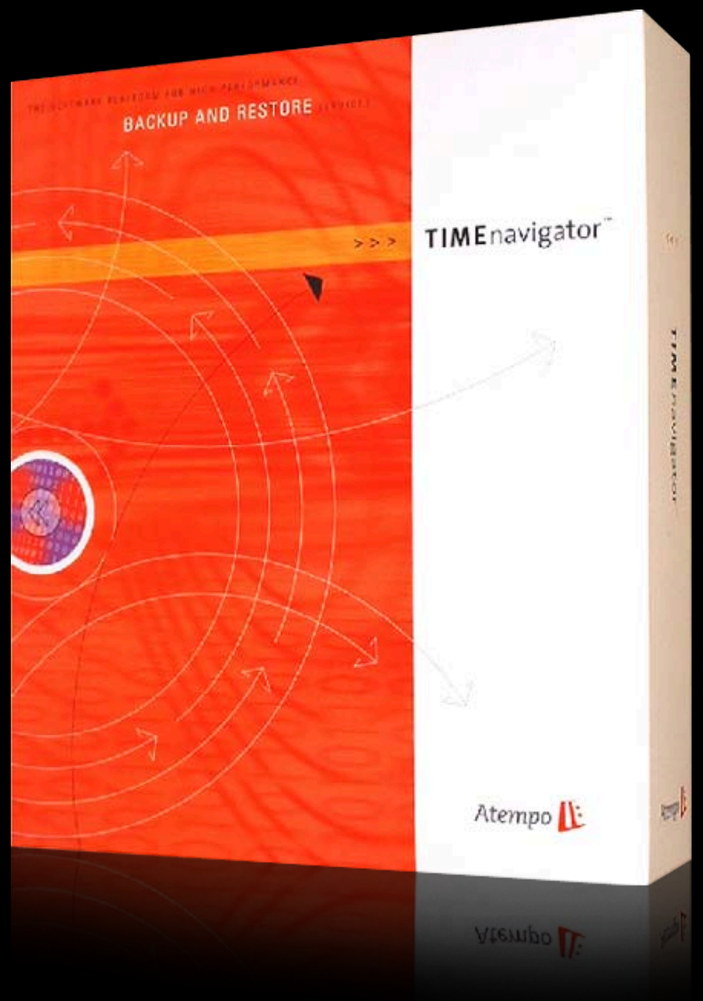
The Solution

- Atempo Time Navigator
  - Xsan support out of the box
  - LTO3 Tape Library support out of the box
  - Professional service team
    - On-Site installation/setup
    - Overall backup strategy assistance
    - Tuned/tweaked for maximum performance in our environment
    - Up and running in 1 day
  - Extreme high performance
    - Able to meet backup window
- But Wait… There's more…



The Solution

- Atempo Time Navigator
  - Object oriented approach makes backups and restored a breeze
  - Time slice approach simplifies restores eliminating confusion in what version of the files/folders are being restored and which tapes are required to do so
  - Synthetic backups
    - Inevitably, sometimes backups fail
    - Time Navigator can generate a synthetic full backup utilizing incrementals
  - Parallel streams allow us to make multiple copies for on-site/off-site archivals in one pass, significantly saving time



Moving Forward

- Planning implementation of Atempo Time Navigator across the board to backup our
  - Windows File Servers
  - Microsoft Exchange Servers
  - Microsoft SQL Servers
  - Apple Mac OS X File Servers
- Centralized, unified interface
- Utilizing our existing AIT-4 tape library

Backup Solution Vendors

Tivoli	LEGATO Keeping the World's Business-Critical Information Available	VERITAS™	BREECE HILL
Computer Associates™	SGL Software Generation Limited GLOBAL DATA PROTECTION	BakBone SOFTWARE	EMC² | dantz
ARCHIWARE	Atempo	TOLIS Group	CommVault® Unified Data Management™

Backup Software Matrix

For Mac OS X Platform

Software	Backup Client Agent	Backup Server	Xsan Support	Tiger Support
Atempo—TIMEnavigator	√	√	√	√
ARCHIWARE—PRESTORE	√			
BreeceHill—INTEGRITY	√	Beta		
BakBone—NetVault	√	√	√	√
CA—BrightStor ARCserve	√			
CommVault—Galaxy	√			
EMC dantz—Retrospect	√	√		√
LEGATO—Networker	√			
SGL—FileNet	√	√		
Tivoli—TSM	√			
TOLIS Group—BRU	√	√	√	√
VERITAS Netbackup/Backup Exec	√			

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